REMARKS/ARGUMENTS

Favorable consideration of this application is requested in view of the amendments made above and the remarks which follow.

A substitute specification is submitted herewith, along with amended claims and a petition and fee for a one-month extension of time. Formal drawings are also submitted under cover of a separate letter to the Drawing Review Branch.

Hydraulic tensioners are known for pre-tensioning studbolts in an environment where there is very little space and high tensile forces are encountered, e.g., in power industry turbine casings. These casings are in two halves, and the joint between the casings must be clamped with sufficient force and consistency to withstand the pressure of steam within and to prevent distortion of the casing. This is generally accomplished by using relatively closely spaced studbolts of large cross-sectional area. However, the reduced separation between the studbolts results in very little working room around the bolts and it is difficult to apply the torque necessary to provide the required tensile load in the bolt.

US patents 3,285,568 (Biach) and 3,707,107 (Bieri), and EP patent EP 0 797 012 (Simms) are exemplary of prior art bolt tensioners.

Biach uses a puller bar 22 with internal threads that engage external threads *on the nut 30*. Tensioner 10 applies a pulling force to the puller bar to apply tensile force on the stud 18, and the reactive force is applied through bridge member 12 *to the article 16* from which the stud projects. A split washer or wedging means 40 with inclined mating surfaces is applied between the nut and the article, and the combined thickness of the two parts of the washer can be adjusted by adjusting the two parts relative to one another.

Bieri uses a puller bar (piston) 12 that has internal threads engaged with the external threads on the end of the studbolt 4. The puller bar exerts tension on the studbolt when pressure fluid is introduced into the housing 9, and reactive force is applied via the unit 8 to either the washer 11 or body 6.

Simms discloses a tensioner which, in one form (fig 1), has a *thread extender 16* attached to the end of the studbolt by a bolt 17 threaded through the extender and into a bore in the end of the studbolt. A collar (puller) 27 is threaded onto the extender 16 and onto the externally threaded end of the studbolt, and a pulling force is exerted on the studbolt by the piston 25 acting through the collar 27, with reactive force being applied via bridge 18 *to the article 11*.

In another form (figs 2 and 3), Simms shows a modified thread extender 36 with an internally threaded enlarged end 36a that is threaded onto the exterior of the studbolt 13, and an externally threaded reduced diameter end 36b that is threadably engaged with the collar (puller) 37. Headed bolt 17 extends through a plain (unthreaded) bore in extender 36 and into the threaded bore in the end of the studbolt. A pulling force exerted on the collar thus exerts a tensioning force on the studbolt through both the externally threaded engagement of the extender 36 and the internally threaded engagement of the bolt 17.

In a still further form (fig 4), Simms shows a modification wherein the collar 27 has an internally threaded end engaged with the externally threaded end of the studbolt, and a stud 47 extends through the collar and is threadably engaged with internal threads in the end of the studbolt. The stud 47 has a nut 48 on its opposite end that is engaged with the collar 27, whereby when a pulling force is exerted on the collar, tension is applied to the studbolt 13 via both the

externally and internally threaded connections with the studbolt. Reaction force is exerted through bridge 18 to article 11.

Patent 3,355,192 to **Kloesel** discloses a tapered threaded connection for drill pipe used in mining, which has for a principal object the provision of a threaded connection which is relatively easy to disconnect (a "break out torque" within the limited capacity of underground tools and equipment available at a mine raise drill – column 3, lines 20-30). Another object is to provide a connection that can withstand repetitive bending moments. The connection includes a tapered threaded pin and a tapered threaded box having shoulders, which engage when the connection is only hand tight. The taper of the pin and box is from 1 ¼ to 1 ¾ inches per foot, and preferably1 ½ inches per foot (6° - 8.5°), and coarse double threads are used, with an engaging flank angle of from 10° - 20° (the angle of the flank of the "buttress" threads employed in this structure). The threads in the box become gradually shallower or "vanish" as they extend axially inwardly of the box, so that there are only about two full turns of complete box threads that are engaged with the pin thread (column 3, lines 50-55).

Patent 1,352,918 to **Rohbock** discloses a flexible and resilient connection between the headed end of a bolt and parts of railroad track that are held together by the bolt. The connection includes a bolt having a head 5 with a part spherical underside 6 for seating on a seat plate 8 having a complementary part spherical seating surface 7. The underside of the seat plate 8 is recessed at 10 to make it flexible when in use. A similar construction is used at the other end of the bolt, which receives a nut having a part spherical underside. The flexible connection, together with the resilience of the seat plates, serves to compensate for and absorb the vibration to which the fastening device may be subjected.

The present invention comprises, in a first aspect, an hydraulic tensioner for applying tension to a studbolt in an environment where space is limited and high tensile forces are encountered, e.g., for securing casing halves together in a power industry turbine.

As set forth in claim 1, the tensioner of the invention includes a puller bar having a threaded end for engagement in an internal thread in an end of the studbolt, a nut assembly comprising a nut having an outer tapered surface, and a collar having a complementary recess for receiving the nut, a bridge for extending around and over the nut and engageable with the collar, and hydraulic means for acting between the puller bar and bridge.

None of the prior art of record discloses or suggests a hydraulic tensioner as claimed in claim 1, and thus in dependent claims 2-8, 15, 21, 22 and 32, wherein the nut has a tapered or conical outer peripheral surface, and the nut is received in a collar or shell with a complementary tapered recess. Further, in claim 1, the bridge acts between the puller bar and the collar. None of the art of record discloses a bridge acting between the puller bar and a collar or shell surrounding the nut.

In Bieri, the bridge 8 acts on washer 11 positioned between the nut 18 and article 6, or, as mentioned in column 5, lines 15-17, the bridge can act directly against the article 6.

In both Biach and Simms the respective bridges act against the article.

Neither Rohbock nor Kloesel remotely relates to a hydraulic tensioner, and neither even has a bridge, much less any suggestion for engaging a bridge between a puller bar and a collar surrounding the nut.

Further, dependent claim 3 requires a stepped thread, and none of the art of record discloses or suggests a comparable thread.

Dependent claim 6 further requires the taper of the tapered end of the puller bar and the taper of the internally threaded bore in the end of the studbolt to be 10°. The taper in Kloesel is described as from 1¼ to 1¾ inches per foot (column 5, line 41). This equates to a taper of from 6° to 8.5°. None of the other patents of record mentions any taper.

Dependent claim 7 requires the pitch of the external thread on the puller bar to be greater than the pitch of the internal thread in the studbolt. In parent application serial number 09/914,346 the examiner took the position that Kloesel discloses this relationship, referring to column 6, lines 19-21. However, this portion of the Kloesel description is referring to the angle of the flank or shoulder of the thread, and not to the pitch of the respective threads. None of the references of record discloses the claimed relationship of the pitch of the respective threads.

Dependent claim 15 requires the first and second annular means meeting at a slip plane, and having releasable means for holding them against relative slippage. Although Biach discloses first and second annular means meeting at a slip plane, there is no releasable means for holding the annular means against relative slippage.

According to a second aspect of the present invention, as defined in claim 9 and thus claims 10-14, 19, 20 and 33 dependent either directly or indirectly therefrom, the invention comprises a coupling for a hydraulic tensioner having a puller bar, hydraulic means, and a bridge, with an internally threaded bore in an end of the studbolt, and a complementary external threaded end on the puller bar, wherein the threaded bore and externally threaded end are tapered and the threads are substantially constant throughout their length and comprise buttress threads. In the parent application, the examiner relied upon Kloesel as teaching the claimed thread construction. However, in Kloesel the threads in the box become gradually shallower or

"vanish" as they extend axially inwardly of the box, so that there are only about two full turns of complete box threads that are engaged with the pin thread (column 3, lines 50-55). The threads do not engage or remain substantially constant throughout their length, as claimed in claim 9. Making the threads in Kloesel constant throughout their length would defeat the invention as described in Kloesel.

Further, dependent claim 10 requires the shoulder of the buttress threads to be substantially perpendicular to the axis of the puller bar. In Kloesel, the shoulder or flank of the threads is at an angle of from 10° - 20°.

Dependent claim 11 requires the pitch of the external thread on the puller bar to be greater than the pitch of the internal threads in the studbolt, and as discussed above, this relationship is not disclosed or suggested in Kloesel or any of the other references of record.

Dependent claim 12 defines the nut assembly, which, as discussed above, is not suggested in the art of record.

Dependent claim 19 requires stepped threads, which, as noted above, are not suggested in any of the art of record.

Dependent claim 33 requires the first and second annular means and releasable means for holding them against relative slippage, and, as noted above, this structure and function are not suggested in the art of record.

Independent claim 16 is also directed to a hydraulic tensioner, wherein the external threads on the puller bar and the internal threads in the studbolt comprise buttress threads having a shoulder or flank lying substantially perpendicular to the longitudinal axis of the puller bar. As noted above, the shoulder or flank of the threads in Kloesel lie at an angle of from 10° - 20°.

Claim 34, dependent from claim 16, further requires the tapered end of the puller bar to be tapered at an angle of 10° relative to the longitudinal axis of the puller bar. In Kloesel, the taper is much less (6° to 8.5°).

Claim 35, dependent from claim 34, further requires the pitch of the external thread on the puller bar to be greater than the pitch of the internal thread in the end of the studbolt.

Claim 36, dependent from claim 35, further defines the pitch of the external thread on the puller bar as 3.005 mm and the pitch of the thread in the end of the studbolt as 3.00 mm. There is no suggestion in any of the art of record of these particular relationships.

For all of the above reasons, it is submitted that the present invention, as now claimed, is not disclosed or suggested in the references of record, whether the references are considered singly or in combination, and a favorable action is respectfully requested.

Respectfully submitted,

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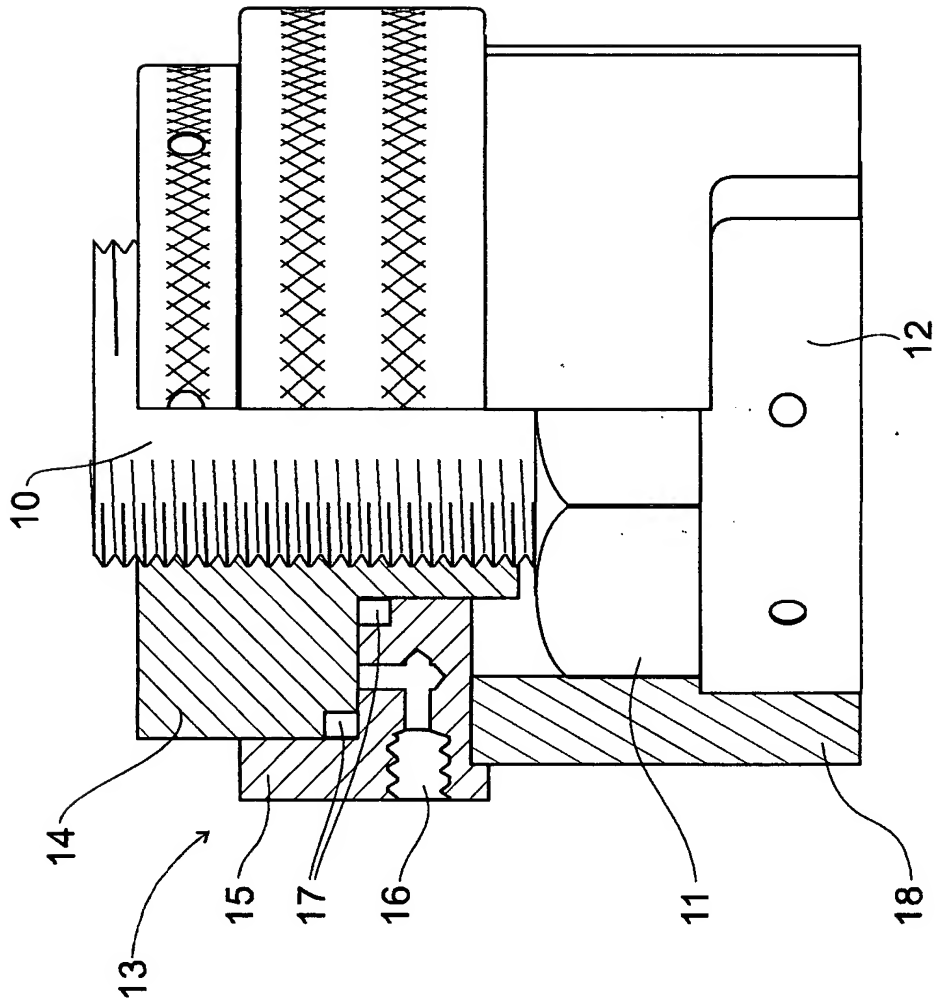


FIG. 1
(PRIOR ART)

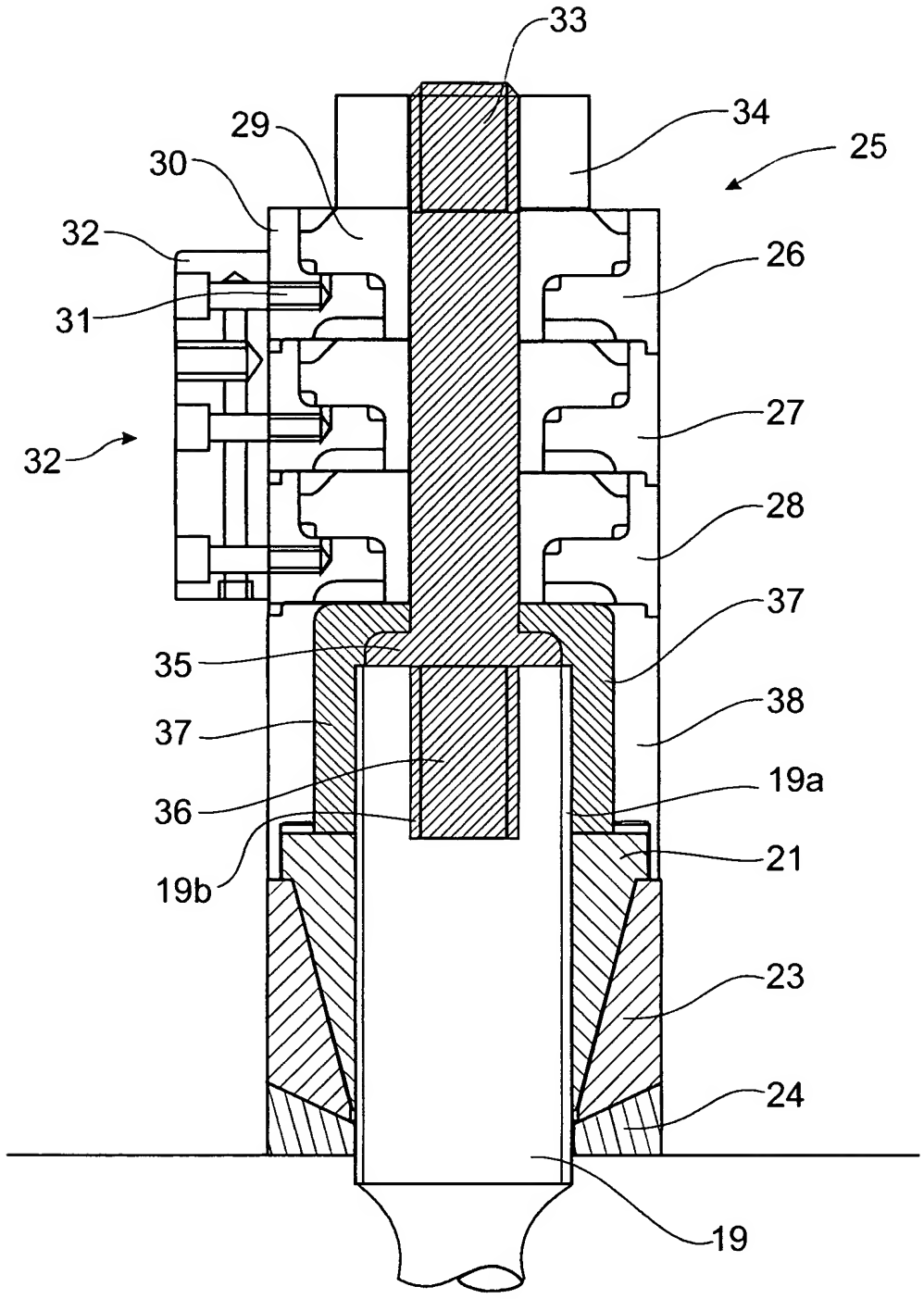


FIG. 4

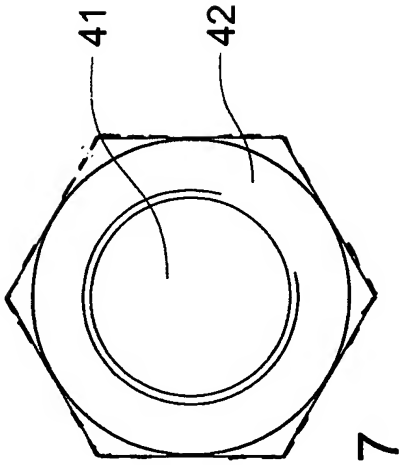


FIG. 7

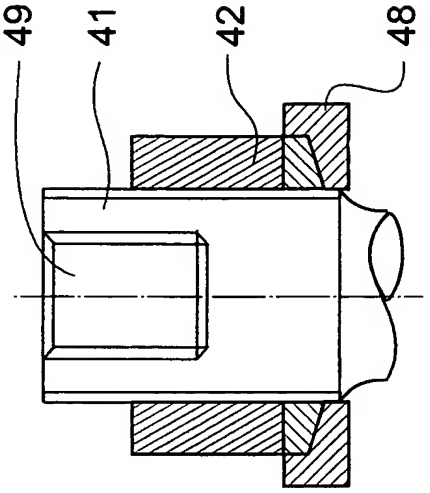


FIG. 8

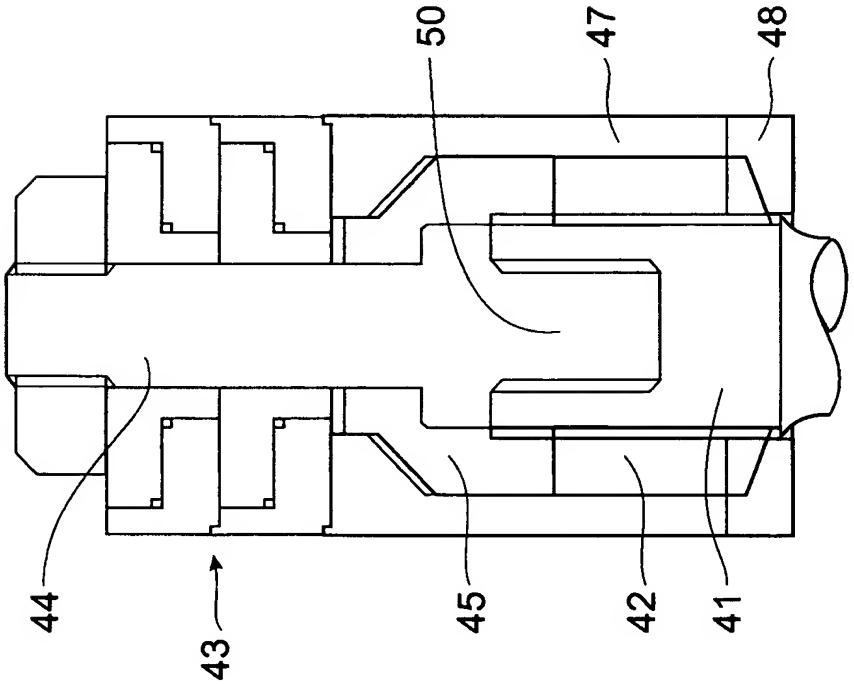


FIG. 6

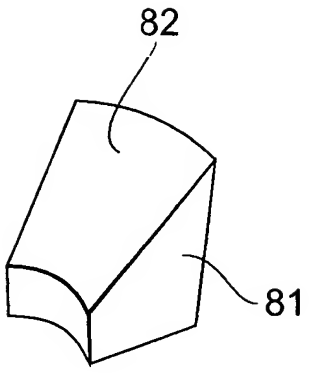


FIG. ~~21~~ 20

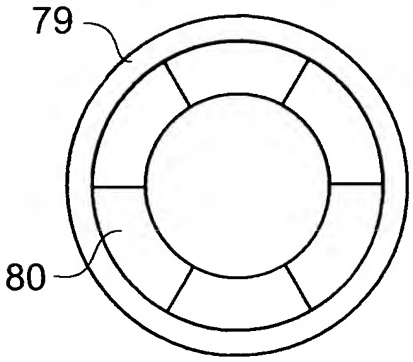


FIG. 19

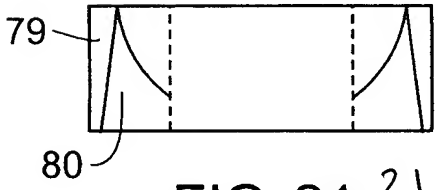


FIG. ~~24~~ 21

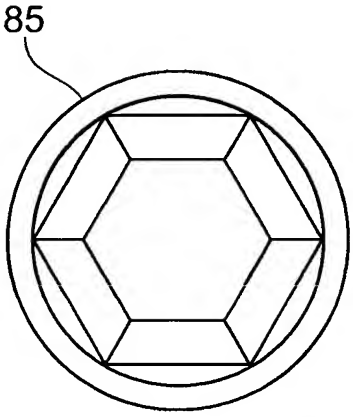
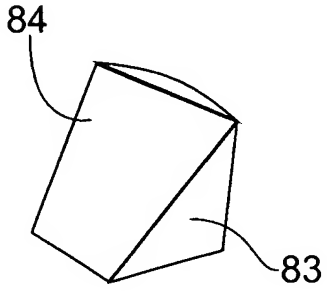


FIG. ~~25~~ 22

FIG. ~~26~~



24

FIG. ~~27~~

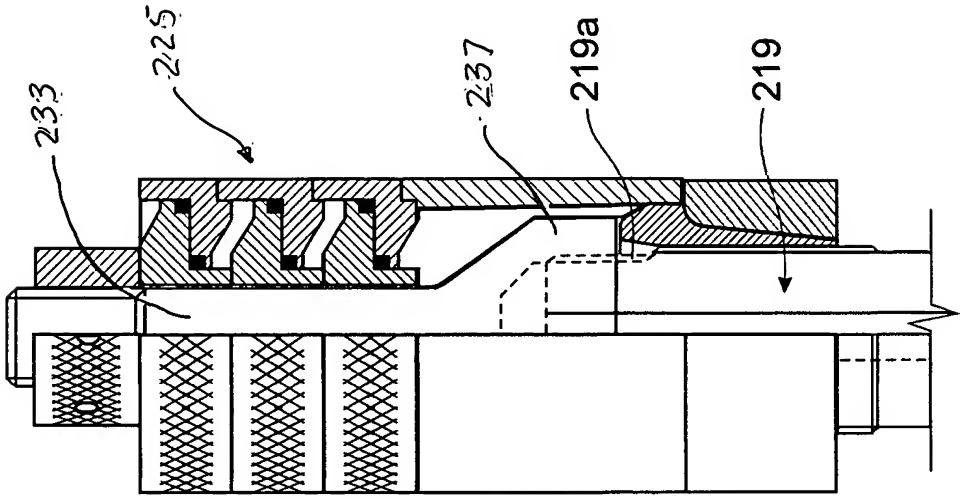


FIG. 27 26

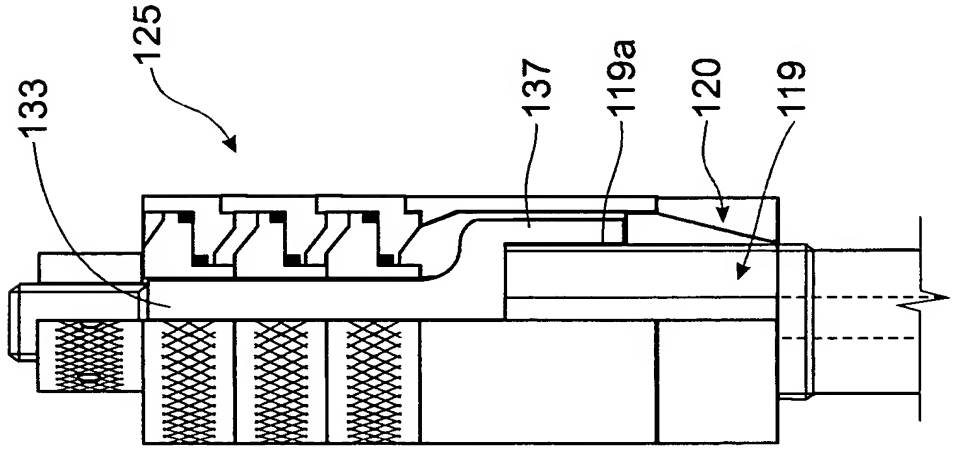


FIG. 28 25

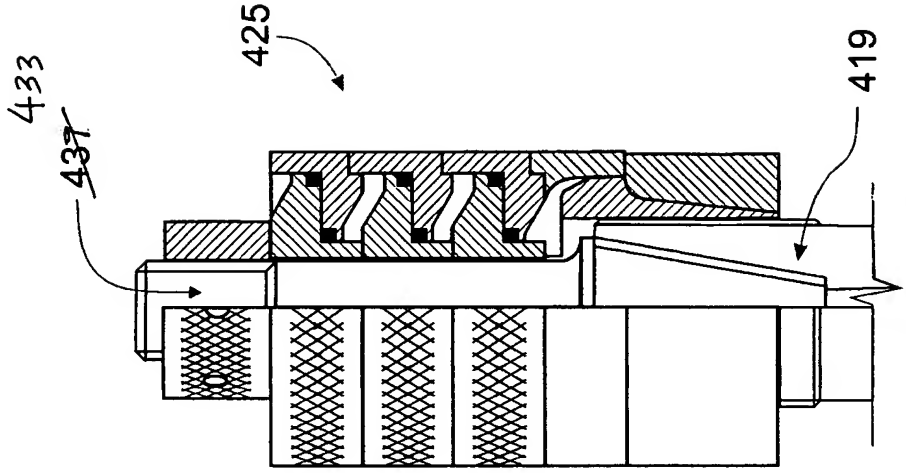


FIG. 32

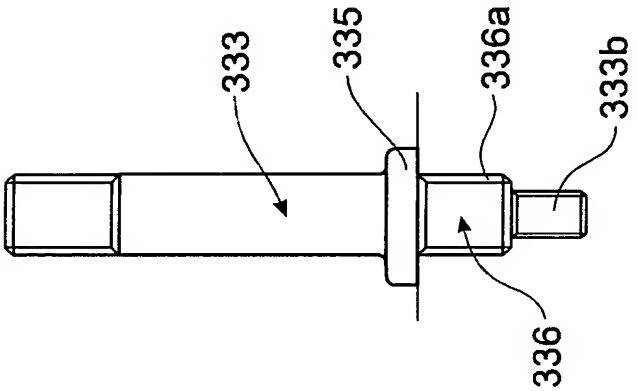


FIG. 31

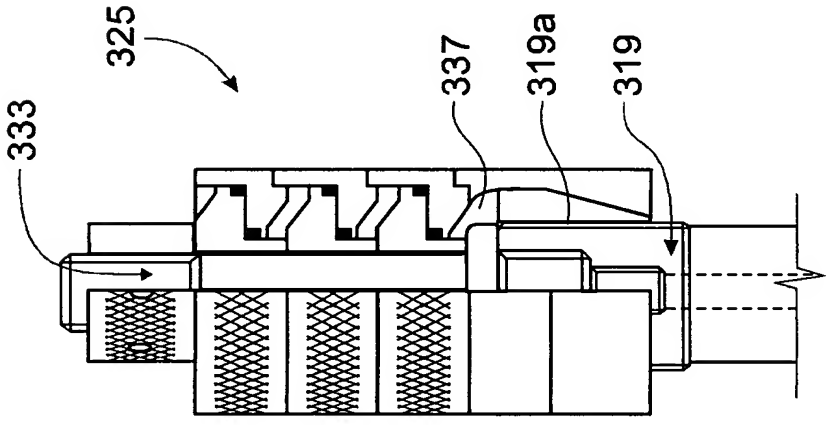


FIG. 30

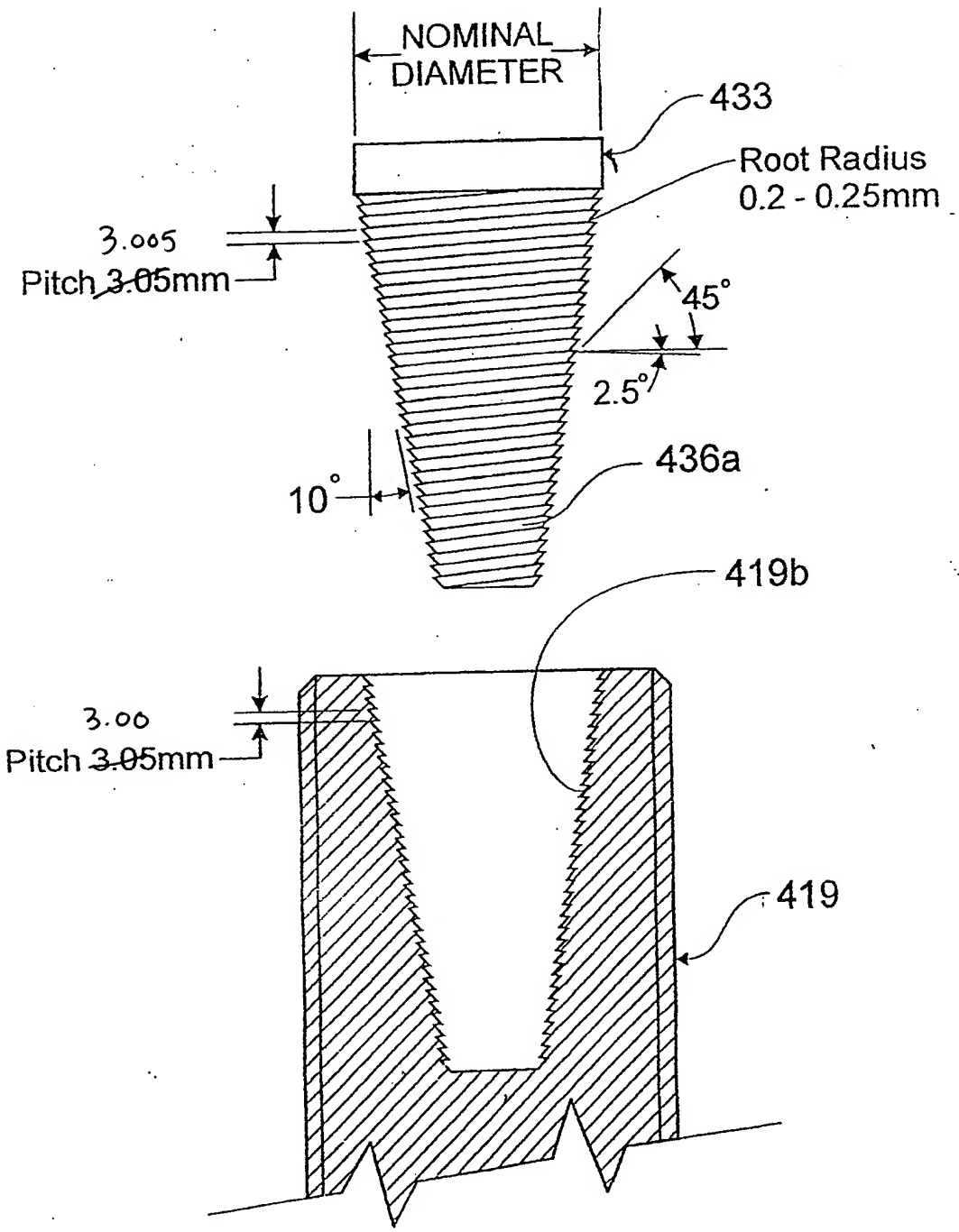

NOMINAL
DIAMETER
433
Root Radius
0.2 - 0.25mm
3.005
Pitch 3.05mm
45°
2.5°
10°
436a
419b
3.00
Pitch 3.05mm
419

FIG. 33 30

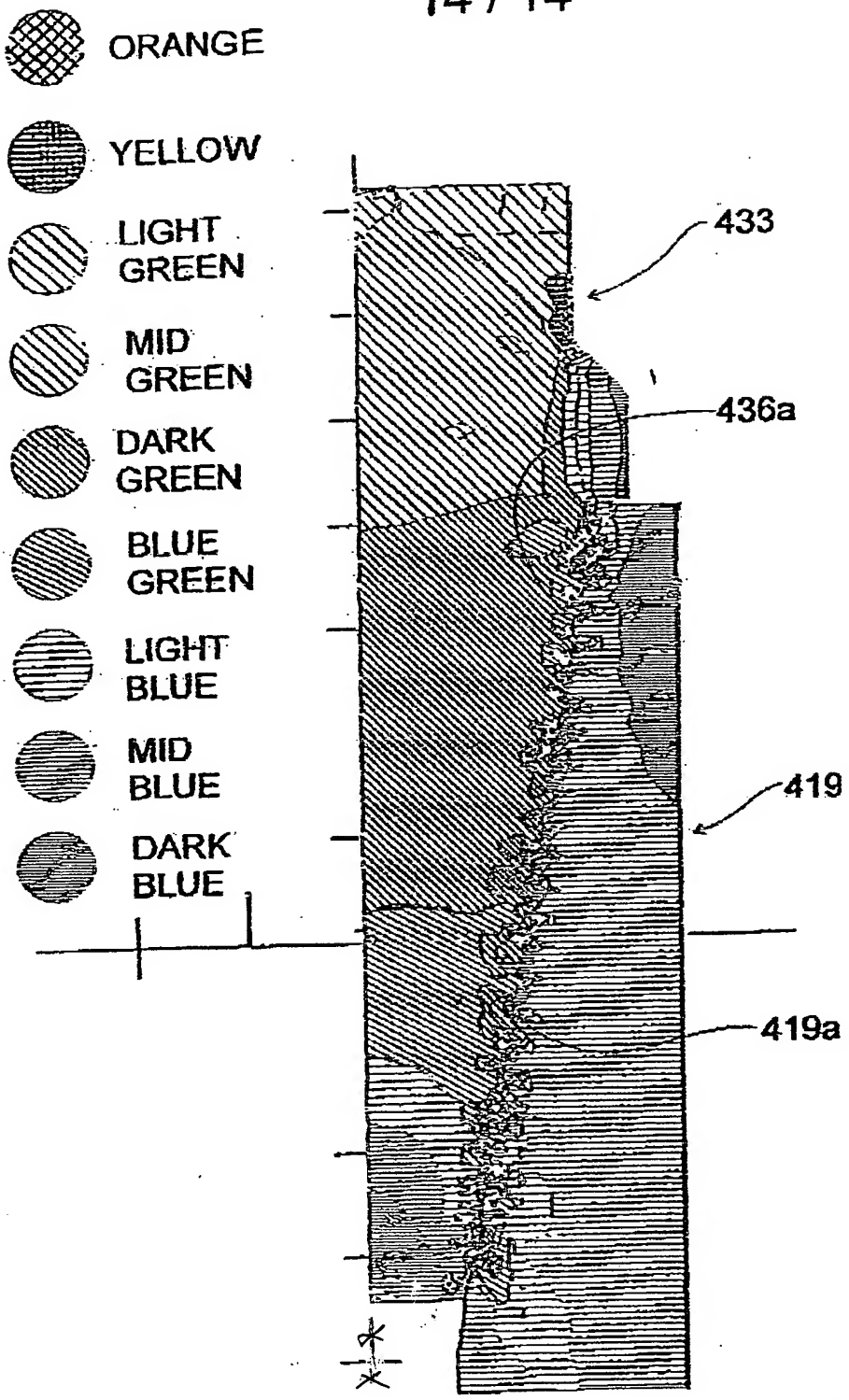

ORANGE
YELLOW
LIGHT GREEN
MID GREEN
DARK GREEN
BLUE GREEN
LIGHT BLUE
MID BLUE
DARK BLUE
433
436a
419
419a

FIG. 34

31